EFFECTIVENESS OF E-CONTENT PACKAGE DEVELOPED FOR TEACHING BIOLOGY AT 11TH GRADE OF SCHOOLING

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ABSTRACT

Recent technological advances have influenced every nook and corner of the world. The incorporation of technological aspect in school curricula is now considered a necessity. Information and Communication Technology in education has the potential to change the deep rooted pedagogical methods for teaching Biology in school. E-Content is a modern weapon to fight against the prevailing rote memorization among students for better understanding of the concepts. In view of the situation arise out of COVID-19, use of E-content in teaching and learning has pushed India a step closer in realizing the dream of digital India. The present study was undertaken to develop E-Content Package as an intervention in teaching Biology to 11th grade school students and to compare the effectiveness of this package with the existing class room practices in teaching biology. A total sample of 60 11th grade school students were exposed to different treatments namely E-Content Package (the special package designed for the purpose) and Existing Practices (ongoing classroom teaching practices in the school) of teaching Biology. The experimental and control groups formed for the purpose were assessed through their achievement scores earned at pre-test and post-test levels of learning by applying t-test. It was found that the students of the experimental group had earned higher achievement scores as compared to that of the students of control group. Hence, the E-Content Package as an intervention of teaching Biology was proved to be highly effective tool for teaching-learning in the school.

KEYWORDS: E-Content Package, Biology, Effectiveness, 11th Grade of Schooling.

INTRODUCTION:

The learners of the present age are exposed to technology and its applications in their day to day life. Technology based teaching and learning provides interesting ways to make the learning an interactive, enjoyable, meaningful and fulfill the very purpose of learning experiences through the continuous efforts. By incorporating more and more technology into the teaching-learning process with its judicious use, we are striving towards a livelier, alert, active and efficient academic environment. The available literature shows that E-Content as a modern weapon of education system is in the process to bring the continuous and desirable changes on the face of Indian classroom transaction which has an everlasting influence on the learners of ever growing emerge out society. Amid nationwide lockdown due to COVID-19, E-Content has emerged as a promising mean to bestow an enriched teaching and learning environment to the masses. E-Content allows students to think beyond what is written in books in limited amount and learn actively at their own pace with the help of especially well-designed packages based on constructivist steps of preparing the lesson plans. Empirical studies conducted in earlier have clearly shown the effectiveness of multimedia courseware on the achievement of students as compared to traditional approaches (Zin, 2009; Khalid, 2010; Kaewkiriya, 2013; and Ussher, et. al 2014). Studies also suggested that E-Content learning material gave students the chance to revise the content regardless of time and it do increase their knowledge in the topic discussed (Karahoca, 2010; Efendioglu, 2012; Rohendi, 2012 and Nugraini, et. al 2013).

In India, a fair amount of literature on E-Content studies dealt with aspects like development and effectiveness of E-content on students' academic achievement (Muthaiyan, 2010; Karthikeyan, et. al 2012; Rekha and Muthuchamy, 2013; Jebaraj and Mohanasundaram, 2015; Chitra and Sivakumar, 2016 and Joan, 2016;), positive attitude towards E-Content (Vasuki, et. al 2014) and E-Content development models (Duraisamy and Surendiran, 2011; and Thakur, 2014). The increasing trend of adoption of E-Content is fast gaining pace and momentum thus making it widely accepted. It is the need of the hour for all educational institutions to facilitate dissemination of knowledge through E-content.

SIGNIFICANCE OF THE STUDY:

The role of a teacher is to help the individual student to imbibe the concept at his/her own pace. Keeping in mind the nature of Indian classrooms especially in rural and hard areas, the prevailing methods of teaching Biology at the senior secondary level whether, knowingly or unknowingly burdened the minds of young students with contents and promoted rote memorization culture through over loaded information available in textbooks only. For better understanding of the biology concepts, the use of E-Content is a boon for students as it includes multi-sensory experiences which increases the curiosity of students so that they can learn interestingly anywhere, anytime and without any difficulty. Keeping in mind the fruitful results of research works of the various authors (Shanmugaraja, et. al 2012; Rekha and Muthuchamy, 2013; Angadi, 2015; and Chitra and Sivakumar, 2016), it can be concluded that E-Content proved its effectiveness at school and college levels for teaching various subjects. The available past literature also shows the path for further investigation that E-Content learning package will certainly be influencing the teaching learning environment to a great extent. This will be a great help to the teachers of Biology to create the proper learning environment within the class room by incorporating the desired technology in school learning. Moreover, the studies from literature pertaining to development of E-content Package in Biology subject are confined to a micro level, therefore, the investigators thought it worthwhile to use this research gap and undertake the present study.

Title of the Study:

'Effectiveness of E-Content Package Developed for Teaching Biology at 11th Grade of Schooling'.

Operational Definition of the Key Terms:
Effectiveness:

Effectiveness in general sense is being able to bring about the result intended. In the present study effectiveness means the influence of the developed E-Content Package to produce a significant change in the behavior of the 11th grade learners in terms of achievement.

E-Content Package:

E-Content Package refers to the learning contents of Biology subject of 11th grade students developed on the prescribed syllabus of Himachal Pradesh Board of School Education, Dharamshala.

Biology:

According to Online Biology Dictionary it is the scientific study of living things and vital processes. In this study, Biology refers to the Biology subject studied at 11th grade of schooling.

11th Grade Schooling:

11th grade schooling refers to the teaching and learning of 11th grade students in a school or formal settings.

OBJECTIVES OF THE STUDY:

1. To compare the achievement test scores of experimental and control groups' 11th grade school students earned by them on the pre-test and post-test levels of testing taught through the E-Content Package and Existing Practices of classroom transaction respectively as interventions of teaching Biology subject in the school.

2. To compare the achievement test scores of an experimental group 11th grade school students earned by them on the pre-test and post-test levels of testing taught through the E-Content Package as an intervention of teaching Biology subject in the school.

3. To compare the achievement test scores of a control group 11th grade school students earned by them on the pre-test and post-test levels of testing taught through the Existing Practices of class room transaction as an intervention of teaching Biology subject in the school.

HYPOTHESES OF THE STUDY:

1. There will be significant differences in the achievement test scores of experimental and control groups' 11th grade school students earned by them on the pre-test and post-test levels of testing taught through the E-Content Package and Existing Practices of class room transaction respectively as interventions of teaching Biology subject in the school.

2. There will be significant difference in the achievement test scores of an experimental group 11th grade school students earned by them on the pre-test and post-test levels of testing taught through the E-Content Package as an intervention of teaching Biology subject in the school.

3. There will be significant difference in the achievement test scores of a control group 11th grade school students earned by them on the pre-test and post-test levels of testing taught through the Existing Practices of class room transaction as an intervention of teaching Biology in the school.

Development of E-Content Package:

The E-content Package for the present study was developed for two chapters 'Transport in Plants' and 'Photosynthesis in Higher Plants' from Unit-IV of 11th grade Biology subject. It was based on the ADDIE model which stands for Analysis, Design, Development, Implementation and Evaluation. It is briefly described as; 1. Analysis Phase (Needs analysis, Target audience analysis and Topic analysis) 2. Design Phase (Framing learning objectives, Selection of instructional media, evaluation and delivery strategies) 3. Development Phase (E-content script writing, Production of video, Audio recording, Storyboarding and Courseware development) 4. Implementation Phase and 5. Evaluation Phase.

Thereafter, the E-Content Package in Biology subject was screened by the subject experts and content developers. Actual class room Biology teachers having more than 10 years teaching experience at the senior secondary level were also consulted for the accuracy of the content matter. The reliability and validity of the package were determined as per procedure of a scientific research steps before using it for conducting an investigation.

Development of Achievement Test:

Achievement Test attempts to measure the present level of performance of the students or the status of the groups prior to and afterward the treatment within a specific period of time. In order to find out the effectiveness of the developed E-Content Package, the investigators developed an achievement test in Biology subject. The items of the achievement test were framed under three domains of Bloom's taxonomy namely Knowledge, Understanding and Application. The test items were pooled from the chapters selected for the purpose out of 11th grade Biology subject to construct and standardize the achievement test. The items of the test were selected on the basis of comments and suggestions of the subject experts and were finalized by determining the item difficulty and item discrimination index. The reliability and validity of the test were determined by standard procedures of a scientific research steps before using it for conducting the present investigation. Therefore, the achievement test in biology was a reliable tool for measuring the academic achievement of students in Biology subject in a selected portion. The achievement test was made ready to be administered at the pre-test and post-test levels of testing.

METHODOLOGY OF THE STUDY:

Experimental Research Method with randomized matched subject control group pre-test - post-test design was employed for the present investigation. 11th grade school students from a school in Shimla district were randomly selected as sample for the study. The sample was bifurcated into two groups equally i.e. experimental group and the control group on the basis of Raven's standard progressive matrices. After the conduction of pre-test for both the groups, the experimental group was exposed to E-Content Package while the control group was exposed to Existing Practices as an intervention for learning in a formal set up. At the end of the treatment, post-test was administered to both the groups.

Variables of the Study:

The interventions in the form of E-Content Package and Existing Practices were the independent variables in the study while the achievement test score of the students earned by them on the pre-test and post-test levels of testing was the dependent variable.

Sample of the Study:

The study was conducted on a randomly selected sample of 60 11th Grade Medical Stream school students from a Government Model Senior Secondary School in Shimla district of Himachal Pradesh.

Research Tools:

The study was conducted through the reliable and valid well-designed self-prepared research tools viz. E-Content Package and Achievement Test.

Statistical Techniques Used:

The achievement test scores obtained on the pre-test and post-test levels of testing by the experimental and control groups' 11th grade school students were calculated by applying the independent t-test and those of the two pairs of achievement test scores based on the pre-test and post-test levels of testing separately obtained by the experimental and control group 11th grade school students were calculated by applying paired sample t-tests.

Analysis and Interpretation:

The obtained data were treated with the help of the most appropriately suitable techniques of the statistics and the results were properly reported in tables as per the requirements of the study.

1. Achievement scores of Experimental and Control Groups' 11th grade school Students

After tabulation of the data, the students of experimental and control groups were compared on the basis of their achievement test scores earned by them in the pre-test and post-test levels of testing and the obtained results were presented in table 1 below:

Table 1: Means, SDs and t-value for Experimental and Control Groups' students at their Pre-test and Post-test levels of testing.

Levels of Testing	Groups	N	Mean	SDs	t-value
Pre-test	Experimental	30	20.93	4.586	0.253 NS
	Control	30	21.23	4.606	
Post-test	Experimental	30	48.93	6.113	15.768**
	Control	30	28.73	3.443	

Note: NS indicates not significant at any accepted level of significance. Table value for the df 58 at 0.01 level = 2.66 and at 0.05 level = 2.00

** indicates that the calculated value is highly significant at 0.01 level of the significance.

Table 1 revealed that the 11th grade students of experimental and control groups did not differ significantly in their achievement at pre-test level of testing since the t-value which came out to be 0.253 could not reach up to the accepted level of significance. The calculated t-value is less than the table value at 0.05 level which clearly substantiated the homogeneity of the two groups before giving them proper treatment with the help of specially designed E-content package and Existing Practices of classroom transactions as the interventions of the teaching in the school.

Further, the t-value (15.768) for the achievement scores earned by the experimental and control groups' 11th grade school students came out to be highly significant at 0.01 level of the significance at the post-test level of testing after giving them proper treatment through the E-Content Package and Existing Practices respectively as the interventions of class room transaction for a specific period of teaching. It indicates that the 11th grade school students of experimental and control groups differ significantly in their achievement at the post-test level of testing in respect of their mode of interventions. The mean score of (48.93) in case of the 11th grade school students of experiment group is much higher than the mean score of (28.73) in case of 11th grade school students of control group. It means that the experimental group students surpassed their counter parts control group students in their achievement due to specially designed package as the intervention of teaching as compared to the existing practices as the intervention of class room teaching. Here, the E-Content Package proved its effectiveness for teaching Biology at 11th grade of schooling.

Hence, the hypothesis stated at Serial No.1 that "There will be significant differences in the achievement test scores of experimental and control groups' 11th grade school students earned by them on the pre-test and post-test levels of testing taught through the E-Content Package and Existing Practices of class room transaction respectively as interventions of teaching Biology subject in the school" is partially accepted.

The finding that the students taught through E-Content Package exhibited better performance than their counterparts in the post-test level of testing, finds congruence with the findings of Muthaiyan, 2010; Kaewkiriya, 2013; Thakur, 2014; Ussher, et. al 2014; and Jebaraj and Mohanasundaram, 2015; who reported homogeneity of the two groups in the pre-test level of testing and better level of achievement of the experimental group than the control group was also reported in the post test level of testing which shows the effectiveness of E-Content materials developed for the purpose over the traditional instructions in the class room teaching.

Figure 1 depicts the actual mean differences of experimental and control groups' 11th grade school students in their pre-test and post-test levels of testing.
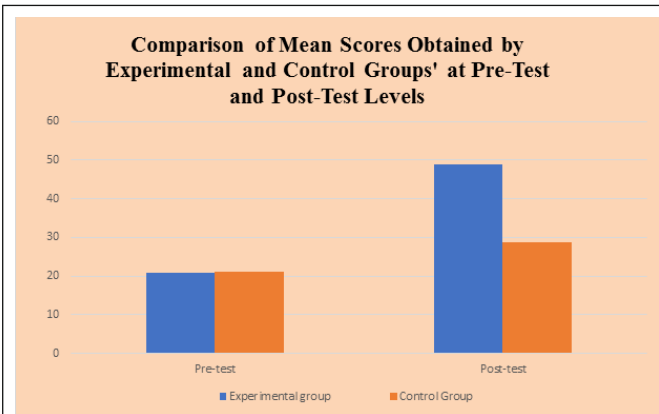
Figure1: Mean differences of experimental and control groups' at pre-test and post-test levels.

Figure 2: Mean differences of experimental group at pre-test and post-test levels.

2. Achievement scores of Experimental Group 11th grade school Students
The obtained results from the two data sets of the experimental group students were compared on the basis of their achievement test scores earned by them in the pre-test and post-test levels of testing and the statistics were presented in table 2 below:

Table 2: Means, SDs and t-value for Experimental Group 11th grade school students at their Pre-test and Post-test levels of testing.

Levels of Testing	N	Means	SDs	t-value
Pre-test	30	20.93	4.586	26.88**
Post-test	30	48.93	6.113	

*Note: ** indicates that the calculated value is highly significant at 0.01 level of the significance.*

The table value with df 29 at 0.01 level = 2.76 and at 0.05 level = 2.05

From table 2, it can be clearly seen that the mean score of (48.93) obtained by experimental group 11th grade school students at post-test level of testing exceeds the mean score of (20.93) obtained by the same group at pre-test level of testing. It is observed that the mean difference of 28 (48.93-20.93) was found between pre-test and post-test levels of the testing of experimental group 11th grade school students which shows the straight forward enhancement of learning through the intervention developed for the purpose. Since t-value came out to be 26.88 which was found highly significant at 0.01 level, it is concluded that there is a significance difference of the two pairs of achievement scores obtained by experimental group students at their pre-test and post-test levels of testing.

Hence, the hypothesis at serial number 2 stated that "There will be significant difference in the achievement test scores of an experimental group 11th grade school students earned by them on the pre-test and post-test levels of testing taught through the E-Content Package as an intervention of teaching Biology subject in the school" is accepted.

Therefore, it can be said that the E-Content Package as an intervention of teaching biology subject in school has significantly enhanced the knowledge attainment level of the students. It means this intervention has influenced teaching learning process of the class room transaction to a great extent.

This finding also got the supports form the research findings of Singh, 2019; Chitra and Sivakumar, 2016; and Joan, 2013; who reported a clear-cut impact of E-Content based teaching on the academic achievement of students in the post-test level.

Figure 2 depicts the actual mean differences of experimental group 11th grade school students in their pre-test and post-test levels of testing.
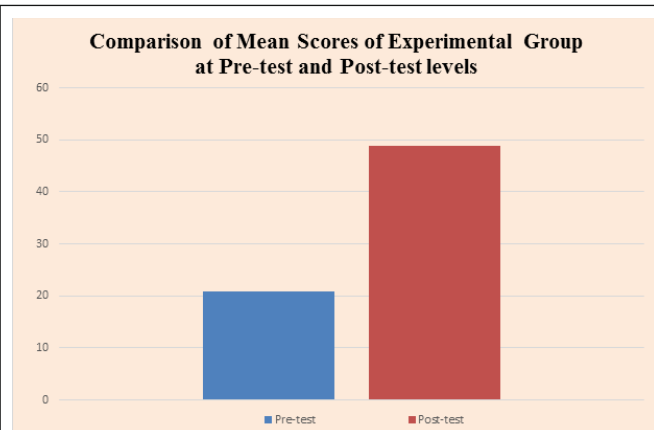
3. Achievement scores of Control Group 11th grade school Students
The performance of the control group students on the basis of their achievement in a two data sets obtained by them in the pre-test and post-test levels of testing were compared and the results were presented in table 3 below:

Table 3: Means, SDs and t-value for Control Group 11th grade school students at their Pre-test and Post-test levels of testing.

Levels of Testing	N	Means	SDs	t-value
Pre-test	30	21.23	4.606	12.74**
Post-test	30	28.73	3.443	

*Note: ** indicates that the calculated value is highly significant at 0.01 level of the significance. df = 29, Table value at 0.01 level = 2.76, Table value at 0.05 level = 2.05*

The calculated t-value of 12.74 came out to be significant at 0.01 level which indicates significance of difference between the mean scores obtained by the control group 11th grade school students in their pre-test and post-test levels of testing.

It is deduced from the table 3 that the obtained mean score of students (21.23) under the Existing Practices of classroom transaction as the intervention of teaching Biology subject at the pre-test level was low as compared to their obtained mean score at the post-test level (28.73). But, it is also observed that the mean difference of these students in the pre-test and post-test levels is merely 7.5. This implies that the Existing Practices in the school to carry out the class room activities as an intervention has also contributed significantly in elevating the level of learning in students but not up to much extent as obtained through the well-designed package of teaching intervention.

Hence, the hypothesis stated at serial number 3 that "There will be significant difference in the achievement test scores of a control group 11th grade school students earned by them on the pre-test and post-test levels of testing taught through the Existing Practices of classroom transaction as an intervention of teaching Biology subject in the school" is accepted.

Similar results were observed in the studies of Zin, 2009; Muthaiyan, 2010; and Rohendi, 2012; who reported minor significant differences in the pre-test and post-test scores of the control group taught through the conventional approach.

Figure 3 depicts the actual mean differences of control group 11th grade school students in their pre-test and post-test levels of testing.
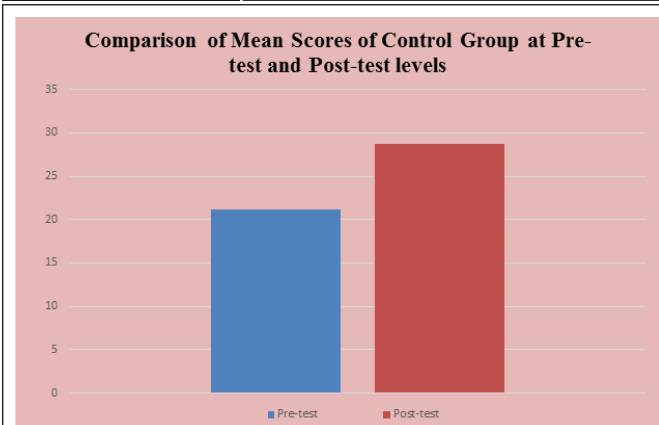
Figure3: Mean differences of control group at pre-test and post-test levels.

MAJOR FINDINGS:

1. No significant difference was found at the pre-test level of testing in respects of the 11th grade school students of experimental and control groups' formed for the purpose but significant difference was definitely observed at their post-test levels of testing after giving them treatment through the specially well-designed E-Content Package and Existing Practices of the school to carry out the class room transaction as the interventions of teaching Biology at this level of schooling.

    Since, the experimental group students performed better in their achievement at post-test level of testing as compared to the control group students, it proved the effectiveness of well-designed E-Content Package over the Existing Practices as the interventions of teaching Biology at school level for enhancing the learning outcomes of the students.

2. The pre-test and post-test results of an experimental group 11th grade school students were also found to be statistically significant which shows the straight forward enhancement in the learning outcomes of the experimental group students. It also proved the effectiveness of E-Content Package for teaching-learning in the class room transaction to enhance the learning out comes.

3. The difference between the pre-test and post-test achievement scores of the control group 11th grade school students was also turned to be statistically significant. The higher post-test mean score of control group students indicates that the Existing Practices in the class room transaction is also enhancing the learning outcomes of the students to some extent but not as much as is enhanced with the intervention of E-Content Package which is new technique of teaching various subjects in the school. This finding of the study also proved the effectiveness of the E-Content Package.

DISCUSSION:

The main objective of the study was to find out the effectiveness of specially designed E-Content Package as an intervention of teaching Biology subject at 11th grade of schooling. The findings of the study proved the very effectiveness of this designed learning package for the students. There is need to replace the old practices of teaching in the class room with this newly developed technique of teaching. It is observed that the experimental and control groups' students were at par with their performance at the pre-test level of testing whenever, a huge difference was observed at the post-test level of testing taught through the designed package of learning as compared to the existing practices adopted for teaching in the school. This implies that E-Content Package has contributed significantly in enhancing the knowledge attainment of students. The results of the two data sets of the pre-test and post-test groups of 11th grade school students based on experimental and control separately yield the higher mean scores in respect of the students taught through the E-Content Package as compared to the old practices of teaching in the school. Hence, the old methods of teaching in the school can be replaced to this technique to enhance the learning outcome and to create better environment in the class room teaching.

CONCLUSION:

From the above discussion, it can be concluded that the development of E-content Package in teaching 'Transport in plants' and 'Photosynthesis in Higher plants' in Biology subject came out to be highly effective tool to yield the fruitful results. The E-Content Package really proved to be a boon to bring the desirable changes in the learning behavior of the students. Thus, it can be said that E-Content Package is a modern weapon in educational scenario that provides opportunity for the learners to study the learning materials at their own pace and therefore, they get motivated for self-learning.

RECOMMENDATIONS:

1. Since, the E-content Package was found to be effective in teaching Biology

subject. Therefore, it can be applied for teaching other subjects like Languages, Mathematics and Social Sciences etc.

2. In-service and pre-service teachers can be given proper training for development of E-Content Package during their training period.

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